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Exploring the Clinical Characteristics and Comorbid Disorders of Borderline Intellectual Functioning

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Borderline intellectual functioning (BIF) is characterized by cognitive impairment and deficits in adaptive functioning. Despite affecting a significant proportion of the population, BIF still remains underdiagnosed and poorly understood. In addition to cognitive impairments across a range of domains, individuals with BIF face a greater risk of academic failure and often require special educational support. They suffer from emotional problems, such as difficulties with emotional awareness, anxiety, depressed mood, and unhappiness. Individuals with BIF are more likely to have an impairment of social and adaptive functioning. Furthermore, individuals with BIF are at higher risk of physical and mental health problems, often receive inadequate treatment, and have a poorer prognosis. This review aims to enhance the understanding of clinicians, educators, and policymakers by providing an overview of the characteristics of BIF and its associated challenges, ultimately contributing to the improvement of support systems for individuals with BIF.

Keywords: Borderline intellectual functioning; Slow learners; Clinical characteristics; Comorbidity.

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INTRODUCTION

Individuals with borderline intellectual functioning (BIF) are often identified by an intelligence quotient (IQ) that is one to two standard deviations below the average in the range of 71–84. The likelihood of encountering an individual with BIF, despite not being aware of their condition, is high. Approximately 12%–14% of the population suffers from BIF in accordance with these criteria [1-4]. Therefore, in a classroom of 25 students, three to four pupils are likely to have BIF [5].

Individuals with BIF have limitations in their cognitive function and in their adaptive function, which affect their academic, social, and work performance [2,6]. Children with BIF have been called slow learners, invisible children, or shadow kids, because they have significantly high failure rates in general education settings, but rarely meet the eligible criteria for special education [1,5]. Individuals with BIF have greater difficulties in meeting developmental milestones, educational and work-related environmental challenges, and complex social demands and transitions [6]. Furthermore, individuals with BIF are more susceptible to experiencing physical and mental health problems compared to the general population [4]. In this context, early intervention could alter developmental patterns, improve educational outcomes, and enhance social functioning.

However, early intervention is hampered by the fact that early recognition of BIF is challenging due to a lack of information on the characteristics of identifying children with BIF [7]. Children with BIF may not be recognized or diagnosed until they are in school, where the social and educational environment challenges child's intellectual and social functions. Only 27% of children and adolescents with BIF are diagnosed and receive professional help. Parents of children with BIF have an insufficient understanding of their children's problems, which may place children with BIF at risk for emotional and behavioral dysregulation and problematic social functioning [8]. This poor understanding seems to be greater than that of parents of children with intellectual disabilities (ID).

This study aimed to enhance the recognition and provision of appropriate support for individuals with BIF by understanding the characteristics and comorbid disorders as-

sociated with BIF. A review of previous studies was conducted, and the demographic information of some studies is presented in Table 1.

CLINICAL CHARACTERISTICS

Individuals with BIF face challenges in various cognitive domains, academic achievement, emotional and motor functions, social recognition and participation, and daily adaptive functioning (Fig. 1).

Cognitive and academic challenges

The cognitive profile of children with BIF differs from that of typically developing children, with the lowest scores on the index related to working memory on the Wechsler Intelligence Scale for Children, Fourth Edition test [9]. In children and adolescents with BIF, total cognition, verbal and visual performance, processing speed, and working memory decline over time [10]. Children with BIF show deficits in visual performance, short-term and long-term memory, working memory capacity, and processing speed and seem unable to catch up with the increasing demands in various domains as

Table 1. Demographic characteristics of included studies

Study	Total, n	BIF, n	BIF IQ	Age (yr)	Male (%)
Água Dias et al. [14], 2019	40	40	71–84	10.03*	60
Alesi et al. [23], 2015	104	25	-†	8.8–9.9	66.3
Alloway [12], 2010	78	39	70–85	7–11	69.2
Baglio et al. [31], 2016	59	28	70–85	9.46*	57.1
Barnevik Olsson et al. [46], 2017	208	50	70–84	4.5–6.5	91.8
Chen et al. [39], 2006	1681	178	70–80	27–33	45.8
Claypool et al. [19], 2008	196	59	70–79	10.9*	55
Dekker and Koot [38], 2003	474	367	60–80	6–18	61.8
Emerson et al. [24], 2010	4337	598	70–85	6–7	-†
Fenning et al. [8], 2007	217	29	71–84	5	58.1
Fernell and Ek [21], 2010	117	38	70–84	16	75.2
Galletta et al. [11], 2020	55	25	71–84	27.64*	16
Gigi et al. [3], 2014	173542	76962	71–84	16–17	100
Hartman et al. [37], 2010	194	61	70–79	7–12	58.8
Hassiotis et al. [4], 2008	8450	1040	70–84	16–74	-†
Karande et al. [18], 2008	55	55	71–84	8–17	63.6
Kortteinen et al. [20], 2009	155	62	71–84	8th grade	33–77
McAlpine et al. [28], 1991	511	25	1 SD below	5–66	48–78
Pulina et al. [9], 2019	264	204	70–85	6–15.5	67.6
Sätilä et al. [10], 2022	651	-†	70–79	5.2–27	63
Smirni et al. [15], 2019	116	65	71–84	126–13.4	50

*mean age; †information was not reported. BIF, borderline intellectual functioning; IQ, intelligence quotient; SD, standard deviation

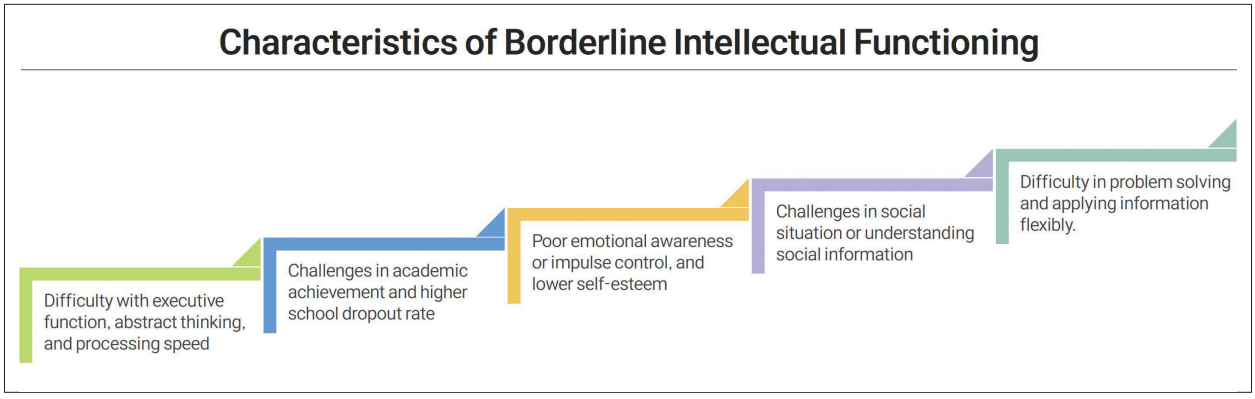

Fig. 1. Characteristics of borderline intellectual functioning.

they grow older [10-14]. Children with BIF perform worse than their normal peers in more complex cognitive domains, including executive functions, abstract reasoning, selective and sustained attention, and perceptual organization [10,12,15]. The increase in these difficulties suggests that children with BIF have marked deficits in the processing and integration of verbal and visual memory information, executive functions and working memory, and more complex reading and arithmetic comprehension. They face difficulties in synthetic and analytical thinking and in generalizing what they have already learned [16]. In addition, due to their slow cognitive processing rate, children with BIF are disadvantaged in acquiring basic developmental skills, such as social interaction, communication styles, and thinking patterns, which can result in them placing approximately one to two years behind their peers [17].

According to the literature, common academic problems experienced by children with BIF are difficulties in writing, spelling, reading comprehension, mathematics, and even overall poor performance in all subjects [10,17-20]. Furthermore, these difficulties become exacerbated as expectations and demands for academic performance increase and tasks become more complex [10-12]. Consequently, the risk of academic failure and school dropout increases [18,21]. Karande et al. [18] demonstrated that over 80% of children with BIF failed examinations and approximately 60% experienced grade retention. Students with BIF can attend school and achieve satisfactory academic performance only by receiving additional individualized education. Children and adolescents with BIF frequently require special educational support, aid at school, adapting subjects, and a modified school syllabus, and this need increases with age [10].

Emotional problems

Higher intellectual function, as expressed by IQ scores, is correlated with better emotional functioning. Adolescents with BIF show significant difficulties in emotional awareness [15]. Emotions require abstract mentalization, a transition from physical sensations to higher cognitive recognition, and they may not be able to fully understand this process because of their limited intellectual and emotional capacities [15,22].

Children with BIF were more likely to experience higher levels of school anxiety and depressed mood and, conversely, lower levels of self-esteem than their peers with average intellectual functioning [23]. Individuals who have experienced repeated failure, such as those with BIF, suffer from severe emotional stress and show higher rates of anxiety, depression, aggression, and the development of neurotic and personality disorders [21,24,25]. Furthermore, a significant positive correlation exists between school anxiety, depressed mood, and insecurity in the BIF group [23]. In contrast, a negative correlation between school anxiety and school self-esteem has been observed. Lower intellectual functioning can lead to an increased perception of negative self-competence and negative affect, including depressed mood, reduced pleasure and interest, irritability, fatigue, and impaired concentration [23].

Individuals with BIF report lower rates of happiness compared to those with higher IQ [26]. Dependency on activities of daily living, income, health, and neurotic symptoms strongly mediate this relationship, reducing the association between happiness and IQ by 50%. Stathopoulou et al. [16] reported that adolescents with BIF scored higher on fear, anxiety, intense nervousness, distress, feelings of having to be perfect, and feelings of inferiority.

Social skill impairment

To function adaptively in social situations, individuals require complex social skills, including recognizing facial expressions, the Theory of Mind (ToM), social interaction and participation, and social information processing. Adolescents with BIF present higher rates of impairment in social functioning, even in the absence of any other psychiatric disorder [3].

The recognition and interpretation of emotional facial expressions are crucial social skills. Children with BIF were less proficient at recognizing facial expressions of emotions than their peers with average intelligence, and the accuracy of facial emotion recognition increased with IQ in the BIF group [27,28]. Van Nieuwenhuijzen et al. [29] found no difference in the recognition of sad, happy, and angry expressions between children with BIF and their typically developing peers, but reported that children with BIF were less able to recognize fear. Individuals with BIF are likely to misinterpret intentions of others because of difficulties in interpreting facial expressions [30].

The ToM, or perspective-taking, is the ability to understand the world through another person's perspective. Children with BIF have a deficit in ToM, which may explain their problems in interpreting other people's behaviors and intentions [29], and is strictly related to their executive functions and meta-representation competencies [31].

According to Roberts et al. [32], concerning peer interaction, children with BIF engage in more solitary play and less interactive play than those with average intelligence. People with BIF experience difficulty understanding social situations. Children with BIF have been shown to have problems interpreting the situations and intentions of others when faced with complex and contrasting information [33]. People with BIF tend not to understand the fine points, nuances, or subtle-

ties of novel or complex social situations and behaviors [34].

Children with BIF appear to differ from their typically developing peers in terms of social information processing, including encoding, interpretation, goal-setting, emotion regulation, response generation, selection, and enaction. The research reported that children with BIF showed more hostile intent attributions, more internal revenge goal settings, more aggressive and less assertive responses, and more confidence in inadequate responses than their typically developing peers [29,33]. Children with BIF tend to rely on past experiences to encode information, a small response repertoire, a positive valuation of submissive but not assertive responses, and a selection of aggressive responses.

Motor skills deficits

Vuijk et al. [35] reported that 60% of children with BIF showed motor skill problems and that there was an association between the degree of ID and performance in terms of manual dexterity, ball skills, and balance skills. Westendorp et al. [36] reported that children with BIF scored significantly lower on most of the 12 motor test items than their typically developing peers, except for gallop, throw, and jump. Although children with BIF had less impaired locomotor skills than children with mild ID, their object-control skills were comparable. This suggests that even minor intellectual function issues can negatively affect object-control skills, which rely strongly on executive functioning. Children with BIF may have more difficulty with object-control skills than with locomotor skills because of deficits in executive functioning [37].

Adaptive functioning challenges

Individuals with BIF had worse outcomes later in life than those with average intellectual functioning, who experienced adaptive functioning difficulties in their youth when examining severe psychiatric problems, inability to work, and ID services.

Research has found that individuals with BIF are vulnerable to risks due to inadequate response systems, interpersonal skills, social judgement, or decision-making abilities, which are associated with limited intellectual and adaptive capacity, leading to difficulties in problem solving and flexible thinking, making them more susceptible to dangers [34]. Furthermore, individuals with BIF often struggle to apply their knowledge flexibly to solve real-world problems, and navigate unpredictable and socially ambiguous situations. Additionally, people with BIF are more likely to experience negative outcomes, such as incarceration and job insecurity, than those with average intelligence [3].

COMORBID DISORDERS

Individuals with BIF are more susceptible to physical and mental health problems than the general population.

Psychiatric disorders

Almost 40% of children with BIF have been reported to have at least one comorbid psychiatric disorder [38]. Psychiatric disorders and mental health problems, such as attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), depression, anxiety, personality disorders, behavioral problems, and substance use, are more prevalent in individuals with BIF than those in the general population [3,4,18,24,38,39]. Dekker and Koot [38] reported that 22% of children with BIF had anxiety, 4.4% had mood disorders, and 25% had conduct disorders. Approximately 30% of diagnosed children received mental health care. Individuals with BIF are more likely to misuse alcohol, and be dependent on alcohol, drugs, and cannabis [4]. Peltopuro et al. [7] and Handen et al. [40] reported that 19%–22% of individuals with BIF have been previously hospitalized for psychiatric treatment. In addition, these individuals have received inpatient psychiatric treatment 3.4 times more frequently and spent more days in psychiatric care than the general population, and even more than people with mild ID or learning difficulties [7]. This suggests that the BIF group has more severe mental health problems that cannot be supported through outpatient care.

Specific learning disabilities

Considerable evidence of an association was observed between BIF and learning disabilities (LD), particularly dyslexia. In principle, there should be no overlap between BIF and LD, as the diagnosis of LD requires normal intelligence and adaptive behavior, but difficulties in a specific area of academic achievement, such as reading or mathematics. In practice, a significant proportion of children with LD have borderline IQs, significant adaptive deficits, and struggle with all academic subjects [41].

ADHD

There are no significant difference in the presentation of ADHD symptoms between children with BIF and their peers with normal intelligence [42,43]. However, ADHD has been shown to have a higher prevalence of almost 20% to 30% [18], with worse outcomes in children with BIF [38,44]. Children with ADHD and BIF respond to stimulants, although the response rates appear to be less favorable [40,45]. The vulnerability to side effects with the doses normally used in ADHD may be subtle and heterogeneous.

ASD

Barnevik Olsson et al. [46] reported that children with both BIF and ASD experience several developmental and neuropsychiatric problems. These include attention deficits, difficulties with regulating activity levels, impulsivity, speech and language problems, and behavioral problems.

Mood and anxiety disorders

Individuals with BIF showed a significantly higher prevalence of depressive episodes, agoraphobia, and other phobias than those with normal intelligence [4]. The prevalence of generalized anxiety disorder, mixed anxiety/depressive disorder, and obsessive-compulsive disorder is not significant but increase in individuals with BIF. Chronic frustration resulting from unmet expectations of family, education, or society is one possible reason for the higher prevalence of mood disorders in individuals with BIF [47].

Behavioral problems

Behavioral disorders were observed in 30% of children with BIF, with a relationship between low verbal or non-verbal IQ and antisocial behavior heavily influenced by sociocultural deprivation [2,48]. Additionally, borderline intelligence, poor academic performance, and early school dropout were associated with later criminal behavior, and this relationship was well mediated by the presence of hyperactivity. Children with BIF and conduct disorders exhibit poorer impulse control than their normal peers, suggesting that they may have problems with inhibitory response [49].

Other medical conditions

Studies have demonstrated that individuals with BIF have higher rates of obesity [34,50]. Young children with BIF were reported to have significantly higher rates of obesity than their typically developing peers, which was partially due to increased exposure to socioeconomic disadvantage [50]. Additionally, people with BIF were shown to have poorer nutrition, and more frequent and longer hospitalizations than the general population [34].

CONCLUSION

Individuals with BIF have traditionally been characterized solely by intellectual functioning and IQ scores. Recently, however, it has been acknowledged that people with BIF have difficulties in both cognitive and adaptive functioning, and not just in intellectual function. They experience impairments in various cognitive domains, including processing speed, working memory, executive function, abstract thinking, and selective attention, leading to difficulties in academic achievement and negative effects on their motor skills and emotions. Individuals with BIF face challenges in recognizing facial expressions, understanding the ToM, engaging and participating in social interactions, and processing social information. They tend to struggle with incarceration and job insecurity due to deficits in their adaptive functioning. Individuals with BIF have a higher risk of developing physical and psychiatric comorbidities, having inadequate treatment, and having a poor prognosis.

A comprehensive understanding of the characteristics of BIF allows for a shift in focus from simplistic categorization by IQ score to adaptive functioning, which is necessary for improving quality of life. Therefore, it is crucial to provide appropriate support and accommodations to improve their adaptive functioning. In addition, early recognition of comorbid diseases is essential for prevention and appropriate intervention, as the presence of comorbidities can affect treatment and worsen the prognosis.

Availability of Data and Material

Data sharing not applicable to this article as no datasets were generated or analyzed during the study.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Minae Kim, Keun-Ah Cheon. Data curation: Minae Kim, Keun-Ah Cheon. Investigation: Minae Kim, Keun-Ah Cheon. Methodology: Minae Kim, Keun-Ah Cheon. Project administration: Keun-Ah Cheon. Supervision: Keun-Ah Cheon. Visualization: Minae Kim. Writing—original draft: Minae Kim. Writing—review & editing: Minae Kim, Keun-Ah Cheon.

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